Weerasinghe, M., Konradsen, F., Eddleston, M., Pearson, M., Jayamanne, S., Gunnell, D., Hawton, K., & Agampodi, S. (2018). Potential interventions for preventing pesticide self-poisoning by restricting access through vendors in Sri Lanka: a study of stakeholders' views. *Crisis*. https://doi.org/10.1027/0227-5910/a000525

Potential interventions to preventing pesticide self-poisoning by restricting access through vendors in Sri Lanka: a study of stakeholders' views

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ABSTRACT

Background

In South Asia, up to one in five individuals who use pesticides for self-harm purchase them immediately prior to the event.

Aims

From reviewing the literature we proposed four interventions: 1) farmer identification cards (ID); 2) prescriptions; 3) cooling-off periods; and 4) training pesticide vendors. We aimed to identify the most promising intervention.

Method

The study was conducted in Sri Lanka. We mapped stakeholders' interest and power in relation to each intervention, followed by a ranking exercise. Seven focus group discussions (FGDs) were conducted to assess facilitators and barriers to implementation.

Results

Vendor training was the most supported intervention, being ranked first by the stakeholders. The participants in the FGDs strongly supported training of vendors as it was seen to be easy to implement, and was considered more convenient. Farmer IDs, prescriptions and cooling-off periods were thought to have more barriers than facilitators and they were strongly opposed by end-users (farmers and vendors), who would potentially block the implementation.

Limitations

Cost considerations for implementing proposed intervention were not considered.

Conclusion

Training vendors might be the most appropriate intervention to restrict sales of pesticides to people at risk of suicidal behavior. This now requires field testing.

Keywords: Pesticide; Stakeholder analysis; Self-poisoning; Suicide

INTRODUCTION

Pesticide self-poisoning is one of the three most common global means of suicide (WHO, 2014), killing 110-150,000 people annually (Mew et al., 2017), mostly in low and middle income countries (LMIC).

In Sri Lanka, pesticides are readily available for purchase over the counter; this increases their accessibility for self-poisoning (Weerasinghe et al., 2014). Data from Sri Lanka (Eddleston et al., 2006; Mohamed et al., 2009) and India (Bose et al., 2009) indicate that 14-20% of individuals using pesticides for self-poisoning had purchased the pesticide from a shop with the sole intention of self-poisoning. This emphasizes the need for an effective approach to reducing inappropriate access to pesticides from shops for self-poisoning.

We explored this issue with pesticide vendors and people who had self-poisoned using pesticides purchased directly from a shop. Based on a review of the literature, we proposed four interventions that could restrict the sales of pesticides for high risk customers: 1) only allowing customers carrying farmer identification cards to purchase pesticides; 2) restricting purchase of pesticides to individuals with official prescriptions; 3) enforcing cooling-off periods between purchase and receipt of pesticides; and 4) training for pesticide vendors to impose restrictions on pesticide sales to customers at high-risk of self-poisoning. Table 1 describes in detail the justification and evidence for each option.

It is unclear that any of these proposed interventions can win stakeholders' support and be implemented in a real-world setting. Engaging stakeholders to learn their concerns and perspectives is considered critical for the success of a new intervention (Namazzi et al., 2013; Hyder et al., 2010). Conducting a stakeholder analysis in the design phase of an intervention is beneficial to identify key stakeholders, assess their interest and their importance to influence the implementation, and to win their support (Varvasovszky & Brugha, 2000; Brugha & Varvasovszky, 2000).

This study aimed to identify the most promising intervention that would increase the likelihood of success in a field setting.

METHODS

Setting

This study took place in the Anuradhapura District of Sri Lanka from April to June 2015.

Design

We undertook stakeholder analyses for each of the proposed interventions in four major steps described below: 1) identification of stakeholders; 2) mapping stakeholders' position in relation to their power (importance and influence) and interest; 3) ranking exercise to prioritize interventions based on stakeholders' preference; and 4) focus group discussions (FGDs) with separate stakeholder groups to assess facilitators and barriers to the implementation of each intervention.

Ethics approval was received from the Ethics Review Committee of the Rajarata University of Sri Lanka.

Identification of stakeholders

We first set up a multidisciplinary research team to identify stakeholders through a brainstorming session. For the purpose of this study, stakeholders are defined as persons, groups or institutions that have an interest in or would be affected by proposed interventions. The selected stakeholders were also asked to assist with identification of additional stakeholders. In this way, a comprehensive list of six stakeholder categories (farmers, pesticide vendors, the pesticide industry, the general community, officials from agriculture and public health) at village, divisional or district level were compiled.

Mapping

Twelve stakeholders representing all stakeholder categories (n=6) were purposively sampled based on their knowledge and experience (Table 2). Using rating scales the participants were asked to rate their interest in, the importance of, and their power towards each of the four proposed interventions.

The stakeholder analysis tools were developed based on previous stakeholder analysis models developed by Pearson (Pearson, 2014). Their interest in each intervention was rated using a 5-point Likert scale (ranging from strongly supported to strongly opposed), whereas importance and influence were estimated using a 3-point Likert scale (agree, neutral and disagree).

The stakeholder analysis grids provide an efficient method of determining stakeholders' power and interest towards the implementation of proposed interventions (Varvasovszky & Brugha, 2000). We used the stakeholder analysis grid used by Namazzi (Namazzi et al., 2013) to map stakeholders' position in relation to their interest and power/influence (Figure 1). This grid allows stakeholders to be categorized into five types; drivers (high power and high interest), supporters (low power but high interest), bystanders (low power and low interest), blockers (high power but low interest) and abstainers (may or may not have power

but neutral to the intervention). Data arising from the ratings of the stakeholders were mapped to this grid, which was then used to identify the most promising intervention.

Ranking exercises

The 12 stakeholders were asked to rank their preference for each of the four interventions on a scale of 1 to 4, where 4 was the highest and 1 was the lowest one.

Focus group discussions

Seven FGDs were conducted separately with the stakeholders listed in Table 2 including 6 to 10 participants in each FGD. FGDs were conducted in Sinhala (the local language). FGDs were recorded and transcripts created.

Analysis

(a). Quantitative data

Ordinal values were assigned to each of the ratings and then quantitative data analyzed descriptively using the ratings of the participants. Given the limitations of self-rated responses, we included both self-rated and others-rated responses as way to minimize bias. Means were calculated for each stakeholder group in each domain: interest, importance and influence.

Measurement of interest, importance and influence

First, the mean of self-estimated interest of stakeholder category *i* for a proposed intervention is ($\bar{x}$);

If;

$$\bar{x} = \frac{\sum x}{n}$$

Where;

$\sum x$ is sum of scores for self-estimated interest by stakeholder category *i*

n is the number of the respondents who reported self-interest

Then, the mean of interest estimated by the other stakeholders for stakeholder category *i is* $\bar{x}$*';*

If;

$$\bar{x'} = \frac{\sum x'}{n'}$$

Where;

$\sum x'$ is sum of scores of interest estimated by the other stakeholders for stakeholder category *i*

n' is the number of the respondents who estimated interest of stakeholder category *i*

If the proportion of self-estimated interest of stakeholder category *i* is *P*;

$$P = \bar{x}\,(\frac{n}{n+n'})$$

If the proportion of interest estimated by the other stakeholders for stakeholder category *i* is *P'*;

$$P' = \bar{x}'\,(\frac{n}{n+n'})$$

Therefore, interest of stakeholder category *i* (I);

$$\mathrm{I} = P + P'$$

Similarly, importance and influence were estimated.

Measurement of power

Power was calculated by combining scores of importance and influence (Pearson, 2014).

Power of the category *i;*

$$POWERcategory\ for\ i = Importance + Influence$$

The findings were summarized and presented in the mapping matrix where power against interest was plotted for each intervention to determine the position of stakeholders for each intervention.

(b). Ranking data

The preference for each intervention was measured using the sum of ranking scores given by the stakeholders. The highest score was considered as the highest preference and the lowest was considered as the lowest preference.

(c). Qualitative data

The deductive thematic approach was used to analysis qualitative data (Barnett-Page & Thomas, 2009). During the first stage of data analysis, each FGD transcript was reviewed and coded by the principal researcher (MW) according to pre-identified themes. The coded transcripts were reviewed and compared by a second team member (SA) for their accuracy. Draft study findings were shared among the team members to validate the findings.

Data quality

We did method triangulation to check out the consistency of data generated by different data collection methods: mapping, ranking and focus group discussions (Patton, 1999).

RESULTS

Stakeholders' position in relation to their power and interest

Stakeholders' power vs interest maps for the proposed interventions are shown in Figure 2. Agricultural officials showed a high level of interest towards the introduction of farmer IDs, cooling-off periods and vendor training; interest towards pesticide prescription was neutral. Public health officials would be either drivers or supporters for all proposed interventions. Farmers and vendors only supported vendor training and they were seen as blockers for farmer IDs, cooling-off periods and pesticide prescriptions. General community would either be supporters or bystanders of the proposed interventions, while representatives of the pesticide industry remained as bystander (onlooker) for all interventions. Vendor training was the most supported intervention by the participant stakeholders whilst the cooling-off period was the least supported.

Findings from ranking exercise

Vendor training was the preferred intervention, being ranked first by the stakeholders as a single group (Figure 3). Farmer IDs were the second most popular intervention followed by prescriptions for pesticides and a cooling-off period before purchase.

Findings from focus group discussions

Focus group discussions provided suggestions for the implementation of each intervention and revealed a complex set of facilitators and barriers for each proposed interventions.

(a). Farmer IDs

Participants in the FGD believed that farmer IDs could potentially restrict access to non-farming family members who are at risk of self-poisoning with pesticides. However, farmers did not support the introduction of IDs since they believed that these would hinder their purchases if, for example, they did not have the ID with them at the time of purchase. Rural vendors knew most of their customers and did not want to have to check IDs, while urban

vendors did not want to check IDs due to delays in service, queuing and possible reduction in sales. The Agricultural officials felt that selection of eligible farmers, issuing IDs to part-time farmers, and processing and distribution of IDs would be complicated and expensive.

".....must be concerned about the majority of legitimate farmers and their convenience. Farmer ID is not a practicable method in the normal life of a farmer." [farmer]

"...It is impossible at peak hours to go through every single customer's ID." [urban vendor]

Participants in the FGD put forward a set of suggestions for implementation of farmer IDs: 1) IDs should be issued to only one person in each farming household; 2) eligible families should be selected by the relevant farmer organization in the village; 3) the minimum age for an ID holder proposed by different stakeholders varied from 16 to 30 years; and 4) should be issued free of charge.

(b). Prescriptions for pesticides

The participants believed that individuals at high risk of self-poisoning are unlikely to go to someone for a prescription, which would cause a delay in the purchase and delay access to pesticides. They might also change their mind during the time it took to obtain such a prescription and then get to a shop. The participants also believed that this approach would reduce the ease with which non-farming individuals could access pesticides from shops as it would be difficult for them to claim the need for pesticides. Public health officers strongly supported the introduction of pesticide prescriptions as they expected such prescriptions would minimize the over-use and misuse of pesticides. Agricultural officials stated that this approach had already been piloted in selected areas and as part of this pilot Agricultural Instructors and vendors had been trained, in two parallel training sessions, to read and write prescriptions (Ministry of Agriculture - Sri Lanka, 2013). The participating agricultural

officials showed some support for the introduction of prescriptions, partly because they felt pesticide selling and buying process would become systematic.

The participated farmers were strongly against it owing to the inconvenience caused to them (e.g. finding a prescriber, being unable to promptly respond to pest damage and being unable to buy the pesticide they wanted). Vendors also opposed it because they would have to increase their labour force to facilitate the reading of prescriptions. The other participants of the FGD identified a number of barriers for the prescription approach: 1) current lack of trained persons on prescription writing in the field; 2) the need for training for vendors to read prescriptions; and 3) recruiting prescribers and training them would be expensive (current lack of sufficient agricultural officials and of resources).

"We don't know whether we will have to cool our heels in the queue to get prescriptions." - [farmer]

Farmers suggested that the prescriber should be available every day (including weekends) and that there should be a minimum of one prescriber for each village.

(c). Cooling-off period between purchase and pesticide acquisition

The participants in the FGD felt that a delay in purchase might prevent a significant number of attempts as most of suicide attempts are impulsive. Further, by delaying purchase there will be an opportunity for vendors to identify and respond to at-risk individuals. Despite the main health outcome, a number of concerns were raised by farmers. One was inconvenience, in particular increased crop damage due to being unable to obtain the pesticide urgently. Urban vendors were strongly against the idea as they would have to increase their labour force to facilitate taking orders.

"….Though it seems to be an answer to reduce pesticide poisoning, the farmers who purchase pesticides for their day to day cultivations don't like it." - [agricultural official]

"At the very first glance we want to buy pesticides, we can't be waiting to buy." - [farmer]

The cooling-off period proposed by participating stakeholders varied from 10 minutes to 24 hours. Placing orders via phone and paying a minimum 50% as an advance when placing an order were two other suggestions put forward by the participants.

(d). Training for pesticide vendors

The participants thought that vendors' contact with high risk individuals provided an opportunity to identify them; for example, customers with unusual behaviour (e.g. garbled speech) or facial expressions (e.g. aggressiveness). Further, the participants believed that many high risk customers do not have knowledge of agriculture, offering an opportunity to differentiate them from legitimate customers. In contrast to the initial stakeholder discussions and mappings (figure 2), all stakeholder groups in the FGDs strongly favoured vendor training since farmers did not think it would affect their current practice, vendors were already trying to do it informally in their daily practice (while appreciating the opportunity for formal training), and the agriculture officials believed that such a training could be incorporated into on-going annual vendor training programs.

"It is a simple practicable method." - [farmer]

"It is a method being implemented to a certain extent at present too." - [vendor]

There were also some barriers identified by the participants. Farmers were concerned that they might be misidentified as a high risk purchaser and refused a sale. Other common concerns included: 1) resources required for initial and refresher training; 2) continuing need for training of new vendor staff; 3) concerns that frequent monitoring and enforcement would be difficult (agricultural officials); and 5) uncertainty whether urban vendors would have time to check the background of a customer.

Participants put forward a number of suggestions about implementing vendor training: 1) vendors expected training to be brief and given at a convenient place and time; 2) training should be given to all sales persons who directly interact with customers; 3) training should be a compulsory requirement for issuing a license to run a pesticide shop; and 4) laws and enforcement should be introduced and implemented in parallel to the training programs and penalty systems should be introduced against mishandling the practices.

DISCUSSION

Vendor training was favoured by stakeholders, but less support for farmer IDs, pesticide prescriptions and cooling-off periods. Also vendor training was the preferred intervention, being ranked first by the stakeholders. These findings verify that vendor training was the most promising intervention and is thus most likely to be most successfully implemented.

Majority of stakeholders were either drivers or supporters towards the implementation of vendor training. It was supported by both policy implementers (agriculture and public health officials) and end-users (farmers and vendors). None of the stakeholders would be blockers for vendor training. The engagement of stakeholders in FGDs gave an in-depth understanding of the facilitators (Varvasovszky & Brugha, 2000) - vendors supported the training, despite the fact that the decisions would directly impact them most while farmers supported it because it would not affect their current purchasing practices. Such training can be incorporated into routine vendor training programs (Control of Pesticide Act, 1980) conducted by the government. The high level of support by the end-users would be beneficial to intervention success (Namazzi et al., 2013).

The three other proposed interventions, farmer IDs, prescriptions, and cooling-off periods, were strongly opposed by end-users (farmers and vendors) who believed they could easily bypass them. This mirrors previous finding from a study with vendors where it was observed

that there was very little support for farmer IDs and prescriptions (Weerasinghe et al., 2014). While these interventions had potential benefits, the cost to farmers and vendors were substantial, especially in terms of time, delays in pesticide application, and inconvenience.

Stakeholders that exhibit a high level of interest for the intervention as well as carrying a high degree of power towards its implementation would be the most desirable as future partners in implementation while those that have low interest but carry a high power should be carefully considered (Brugha & Varvasovszky, 2000; Pearson, 2014). Consideration of the position of the participants at a program design stage could help determine likely the success of interventions (Brugha & Varvasovszky, 2000). End-users of policy are often the most crucial group that needs to be considered in evaluating options as they are directly affected by the proposed changes. Opposition from the end-users of policy is major barrier to effective implementation (Namazzi et al., 2013). This highlights the need to involve policy end-users at the programme/pilot design stage to identify both real world barriers and potential modifications that can be made (Varvasovszky & Brugha, 2000). In this study the end-users (farmers and vendors) made a clear choice of their favoured intervention suggesting that this intervention would enjoy support at the implementation level. Other options where end-users opposed would likely be more difficult to implement and, therefore, need to garner greater support to be successful.

Policy makers are another group that needs to be considered in selecting an intervention. Policy makers would need to devise and support changes for the intervention to be successful (Choi et al., 2005). Opposition at this level may result in interventions never being fully enacted. In our study the officers at policy implementation (Agriculture and Health officials) were generally supportive of all the interventions and happy to play supportive roles in implementing all proposed interventions.

The community supported all interventions except the cooling-off periods before purchase. Although the community is not a direct beneficiary from the proposed interventions, they were perhaps glad to see the overall health benefits to society. The industry was not perceived by the participants to have much power to influence decision making. This may reflect the limited number of participants and local focus of this study. It is likely that industry would play a bystander (low interest and low power) role for vendor training however if the interventions became more widespread and led to reduced sales it is imagined that their position and opposition may change. However, both community and industry would have the potential to be galvanized to create consensus for all activities.

Vendor training was considered by all groups to have greater facilitators than barriers for implementation. Therefore, the findings of this study suggest that among the proposed interventions, vendor training would be easier to implement at the field level. The likelihood of its success as an intervention could be further tested in field trials for its acceptability and feasibility.

There are several limitations to our study. This study primarily focused on local (village, divisional or district) level stakeholders. This may have limited our understanding of national and transnational issues such as industry (pesticide manufactures) perspectives. Also approaching national level policy makers, such as the Ministries of Agriculture and Health, was not within the scope of this study. Another limitation was that the stakeholders' positions for interventions were initially mapped using small numbers. As such, there may be potential selection bias, not all views may be well represented hence their position for each intervention cannot be generalized to cover the entire stakeholder category. However, we used different approaches to validate the findings and the FGDs, which were larger (total of 54 people), had generally consistent responses. Cost considerations for implementing proposed intervention were also not considered in this study. There is currently no data on

risk factors that can help identifying individuals purchasing pesticides from shops for self-poisoning in other LMICs. Hence this approach may not be generalizable to other settings.

CONCLUSION

Vendor training had the most support from stakeholders and is thus most likely to be easiest and most successfully implemented. Although stakeholders supported vendor training, it is not clear that it will actually be effective or have impact on pesticide self-harm. This needs to be tested in future field trials. Other proposed interventions, such as farmer IDs, prescriptions and cooling-off periods, had strong opposition from end-users and, therefore, will require greater support to be successful.

Funding:

The work was funded by the American Foundation for Suicide Prevention (DIG-0-095-12) and by the Wellcome Trust (GR090958).

Competing interests:

The authors declare that they have no competing interests.

Acknowledgements:

The first author gratefully acknowledges the support of Brocher Foundation in Hermance, Switzerland (www.brocher.ch) which provided a pleasant setting in which to complete the first draft of this paper. ME was a Lister Research Prize Fellow. DG and KH are both National Institute for Health Research (England) Senior Investigators.

Authors' contributions:

Study conception and design: MW, FK, ME, MP, KH, DG and SA; Data collection: MW; Supervision and analysis: MW, SA and MP; Interpretation of data and drafting of manuscript: MW, ME, DG, FK and MP; Critical revision: All authors.

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Figure 1: Stakeholder analysis grid used by Namazzi et al (Namazzi et al., 2013).

Figure 2: Maps for proposed interventions - stakeholder power vs interest. The interventions with the strongest support are those with the highest number of stakeholders appearing in the top right segment of each grid.

Figure 3: Preference of stakeholders for proposed interventions. The intervention with highest preference is the largest circle in size whereas the intervention with lowest preference is the smallest circle in size.

Table 1: Possible approaches to reduce access to pesticides from shops for self-poisoning

Intervention	Justification of selection	Restricted high risk customers	Evidence
Identification cards for farmers	Within agriculture restricting access to certain highly toxic pesticides is commonly practice through registration and identity systems – e.g. in Sri Lanka, only coconut farmers can buy monocotopus. In Sri Lanka 45% - 60% of the individuals who accessed pesticides from shops for self-poisoning were non-farmers (Eddleston et al., 2006; Mohamed et al., 2009).A farmer ID could potentially restrict access to a majority of non-farmers at risk of self-poisoning with pesticides.	Non-farmers	Permit-to-purchase handgun laws in certain states in USA to reduce suicide rates (Crifasi, Meyers, Vernick, & Webster, 2015) Farmer IDs are being successfully piloted in selected area of India (The Hindu, 2012) and Nepal (The Kathmandu Post, 2014) to facilitate farmers to transport their produce and to motivate young people to take up agriculture as a career.
Prescriptions for pesticides	This approach would also reduce the ability of non-farming individuals to access pesticides from shops as it would be difficult for them to claim the need for pesticides.	Non-farmers	Prescriptions have been successfully applied to restrict access to medicine as a means of suicide prevention (Nordentoft, Qin, Helweg-Larsen, & Juel, 2007). Prescriptions are being successfully piloted in Sri Lanka (Ministry of Agriculture - Sri Lanka, 2013) to impose restrictions on sales of pesticides in private shops.
Cooling-off period between purchase and pesticide acquisition	The majority of suicide attempts in Asia are impulsive (with little planning), a delay in purchase might prevent a significant number of attempts. In a study in Sri Lanka, over half of all people who ingested pesticides in a suicide attempt had considered their action for less than 30 minutes after deciding to self-harm (Eddleston et al., 2006).	Individuals with impulsive suicide attempts	Cooling-off periods between gun purchase and possession has been successfully used as a prevention strategy of firearm suicide in the USA(Loftin et al., 1991) and in Australia (Cantor & Slater, 1995).

Training for pesticide vendors	Alcohol has been found to be a risk factor for self-harm in Sri Lanka (van der Hoek & Konradsen, 2005). Avoiding the sale of pesticides to alcohol intoxicated individuals and/or non-farmers may prevent nearly three quarters of individuals at risk of self-harm (Weerasinghe et.al under review).Vendors' initial contact with high risk individuals provides an opportunity to identify them.	Non-famers; alcohol intoxicated persons; distressed customers	"Gun shop" project in USA - engaging firearm retailers to reduce firearm suicides ("Gun shop project - Means matter," n.d.). Pesticide vendors are keen to find ways to reduce the number of times self-harm occurs soon after purchase of pesticides (Weerasinghe et al., 2014).

Table 2: Stakeholders identified for the pesticide vendor study in Sri Lanka.

Stakeholder category	Individual stakeholders (n = 12)	Focus group discussions (n = 7)
Farmers	President of a farmer organization	Rural farmers
	Large-scale vegetable farmer	Urban farmers
Community	Monk	Local administrative officers *(Grama Niladhari)*
	University lecturer	
	Self-poisoning patient who accessed pesticides from a shop	
	Divisional Secretariat	
Industry	Company representative	-
Pesticide vendors	Rural vendor and commercial pesticide sprayer	Urban vendors
		Rural vendors
Agriculture	Provincial Additional Director	Agricultural officers
	Agricultural Inspector	
Public health	Public Health Inspector	Public health midwives
	Medical Officer of a rural hospital	

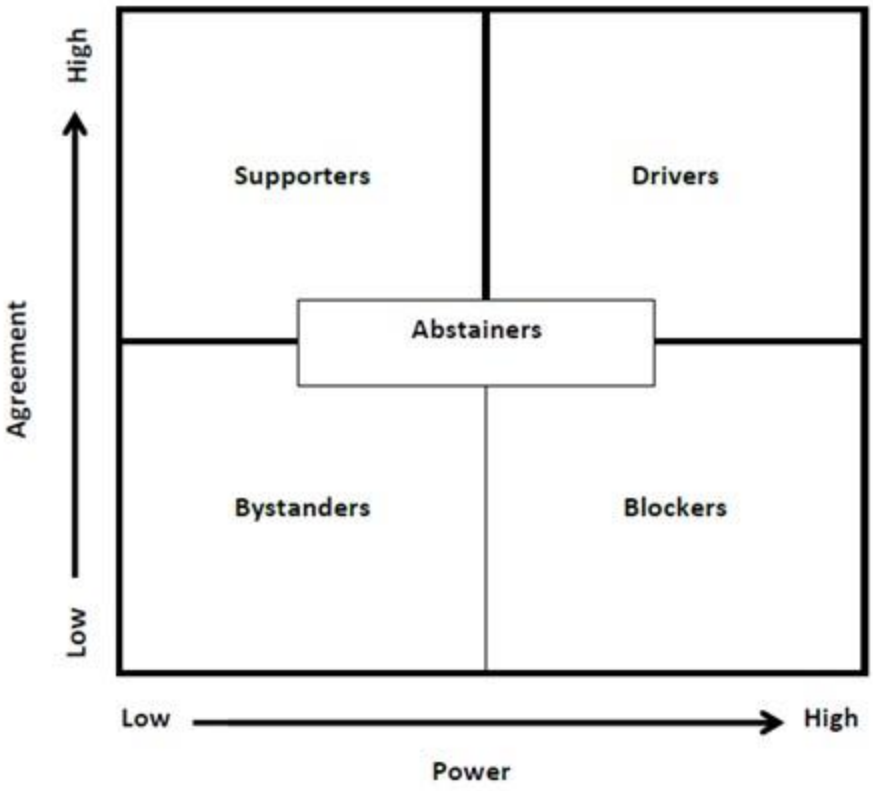

Figure 1: Stakeholder analysis grid used by Namazzi et al (Namazzi et al., 2013).

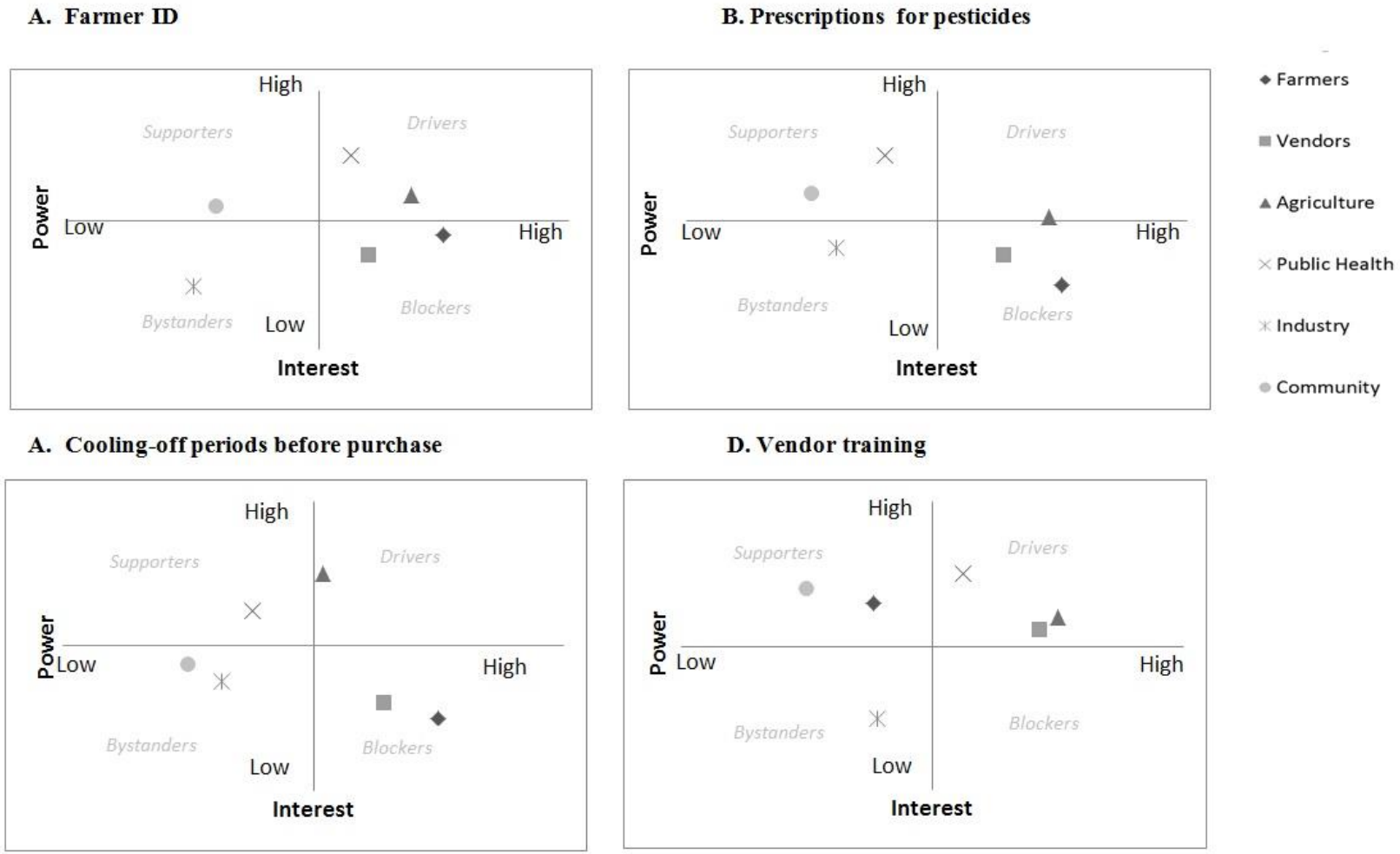

Figure 2: Maps for proposed interventions - stakeholder power vs interest. The interventions with the strongest support are those with the highest number of stakeholders appearing in the top right segment of each grid.

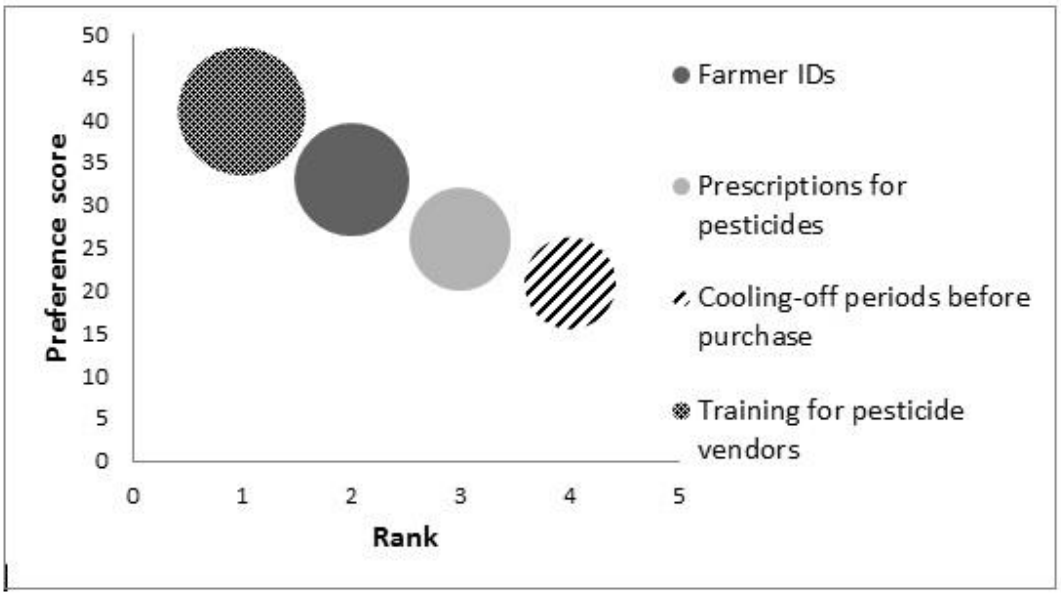

Figure 3: Preference of stakeholders for proposed interventions. The intervention with highest preference is the largest circle in size whereas the intervention with lowest preference is the smallest circle in size.